COST ESTIMATING

GENERAL

The quantity of the various materials involved in the construction of a project are needed for determining the cost of the project and to establish a base for the Contractor's bid and payment.

Quantities for determining cost estimates are required throughout the various stages of a project development, as their need arises, beginning with the conceptual studies to the completion of the final contract plans. These quantities are calculated from the best information available at the time. Quantity calculations shall in general be made during the following stages of the project development.

CONCEPTUAL STAGE

During the conceptual stage of the project, estimated quantities may be required to evaluate the most economical structure for the bridge site. The need for quantities will depend upon whether or not reasonable cost records are available from which an estimated square foot cost can be determined. Each Design Unit Supervisor will have a current Cost Data Book (Strip Set) that will include a square foot cost for most types of structures.

PRELIMINARY PLAN STAGE

Upon completion of the preliminary plan, estimated quantities shall be figured by the designer. It is his/her responsibility to arrive at a Preliminary Cost Estimate which is included in the transmittal letter sent to the appropriate parties along with the Preliminary General Layout. The designers files must include documentation of the items included in the Preliminary Cost Estimate. The estimate, at this stage of project development, shall include an amount of 15% for contingencies. Estimated unit prices will be taken from the current Cost Data Book. Either the average values or project-specific data may be used by the designer and included in his/her documentation.

DESIGN STAGE

As the design progresses, and refinements in the design are made, if new quantities x cost of the bid unit vary more than 10% of the total cost previously submitted with the General Layout, a new submittal shall be sent to the appropriate parties so that they may be made aware of the total cost revision.

BID PROPOSAL STAGE

The need for a basis for contractor bidding and payment requires that upon completion of a design project the quantity of certain materials involved in the construction of the project be computed. Bid items and their listed sequences are standardized and are set forth in the list of Standard Bid items found in the current Cost Data Book compiled by Cost Estimates Squad of the Staff Design Branch. On occasion, for special situations, a bid item may be required which is not a "Standard Bid Item".

Those bid items which involve payment based on a quantity of material require that the material for those items be calculated and shown in the plans in the Summary of Quantities Table.

COMPUTATION OF QUANTITIES

RESPONSIBILITIES

The structural design team has the responsibility to compute quantities. Each design team shall be responsible for alerting the appropriate parties when alterations are made in the design features which will affect the cost of the structure.

PROCEDURE FOR COMPUTATION

Quantities are to be computed and checked independently. Each person shall summarize his/her figures. See the section covering quantity calculations in the CDOT Bridge Detailing Manual. The two summaries are to be compared. In addition, the breakdown for each quantity shall be checked item by item. For example, the originator's figures for excavation for each of Piers 1, 2 and 3 should be compared separately against the corresponding figures made by the checker.

All quantities and summaries of quantities are to be filed in the job file with any subsequent revisions to these figures. All revisions shall be checked in the same manner as the original quantities. On the "Summary of Quantities" sheet, the original figure should not be erased, but crossed out and replaced by the new figure in a different colored pencil. If there are too many revisions, the old summary sheet should be marked void, left in the file and a new sheet filled out. The new summary sheet is to be marked "Revised" and dated.

This procedure makes it necessary that before making the calculations, the checker shall determine which method of breakdown the originator used for his or her calculations to facilitate checking. Mistakes in quantities can be very costly to the department.

DATA SOURCE

The completed design drawings are used in computing the quantities for determining the final estimated construction cost and listing in the bid proposal.

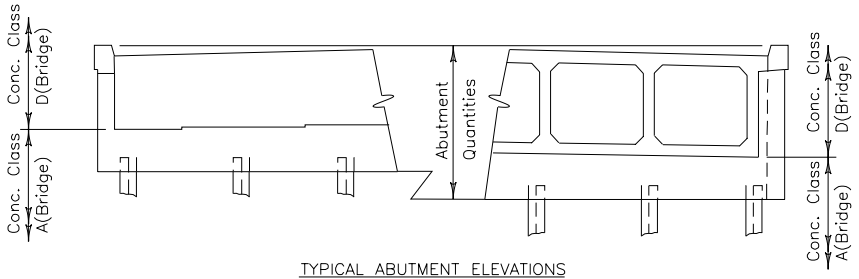
ACCURACY

Quantities used in the development of cost estimates during the conceptual stage of the design are expected to have an accuracy of ±10%. The first iteration of quantities after the preliminary plan has been completed is expected to have an accuracy of ±5%.

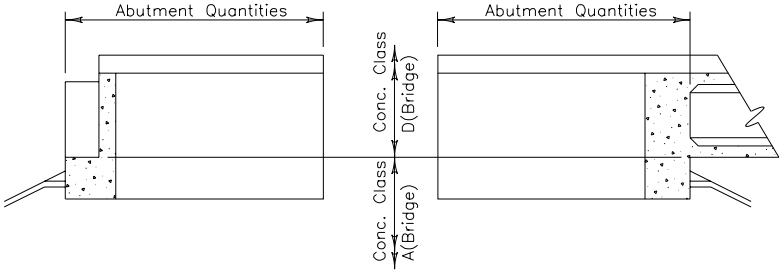
Final quantities to be listed on the Summary of Quantities sheet are to be calculated to have an accuracy of ±1%.

FORMAT

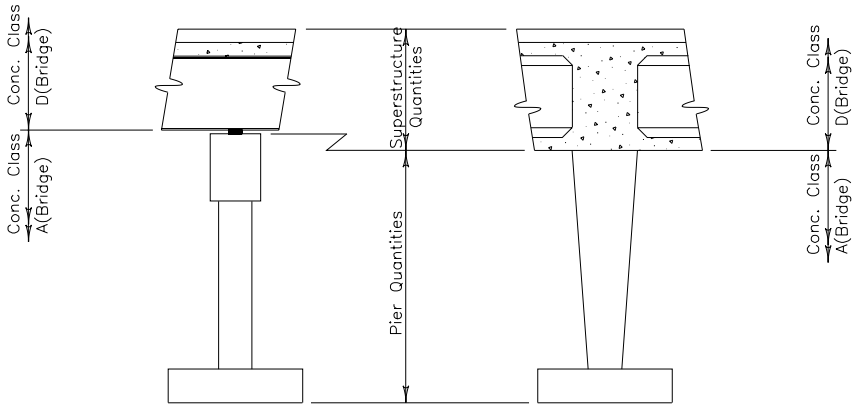
The format is covered in the CDOT Bridge Detailing Manual under the section on quantity calculations. Also see CDOT Bridge Design Manual *Section 18.3*.



TYPICAL ABUTMENT ELEVATIONS



TYPICAL ABUTMENT SECTIONS & WING ELEVATIONS



TYPICAL PIER & SUPERSTRUCTURE SECTIONS

BID ITEMS AND QUANTITIES

BID ITEMS AND PAY UNITS

Each bid item shown in the Summary of Quantities for Structures shall be taken from those coded and authorized by Staff Design Branch Cost Estimates Squad. Bid items are to be listed in the sequence shown in the latest edition of "Item Descriptions and Abbreviations" as compiled by the Cost Estimates Squad. For items or pay units not currently listed in the "Item Book", the Cost Estimates Squad will provide the appropriate coding sequence.

A description of the work, method of measurement and basis of payment is required for each bid item used. If this description is not given in the "Standard Specifications for Road and Bridge Construction" or a Standard Special Provision, it must be given in a Project Special Provision.

QUANTITIES AND QUANTITY CALCULATIONS

Two independent sets of quantities shall be calculated. Each set of quantities for each structure shall contain a quantity form filled out using proper item numbers, descriptions, and units. Differences shall be resolved and totals from the record set shall be shown in the plans. Extended totals for both sets of quantities shall be within one percent of each other, except that the totals for excavation and backfill within five percent are acceptable. Note, quantities from the two independent sets are not to be averaged.

All extended totals are to be rounded to the nearest whole unit, except timber and treated timber shall be rounded to the nearest 100 feet board measure (0.1 MFBM). Individual totals for structure elements shall be to the nearest whole unit, except concrete and timber may be shown to the nearest tenth of a unit. If necessary, adjust the element totals to agree with the rounded extended total.

Logical breaks between substructure and superstructure quantities shall be used for calculations. Such breaks may be construction joints, bearing seats, expansion devices, abutment front face, abutment back face or such breaks as indicated on the plans.

The following will be included as roadway quantities only and will not be shown on the bridge summary:

- All revetment such as slope mattress or riprap
- Excavation and backfill relating to revetment installation
- All excavation and embankment for spur dikes, channeL improvements or bike paths
- Unclassified Excavation